# Leaf rust of wheat in Canada in 1978[1]

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Leaf rust was first found in Manitoba on June 21. It was widespread in Manitoba and eastern Saskatchewan by mid-July but subsequent development was slow and leaf rust caused little damage to wheat in 1978. Identification of races from leaf rust survey samples was carried out with 19 backcross lines with single genes for resistance as differential varieties. Lines with resistance genes *Lr 17*, *Lr 76*, *Lr 79*, *Lr 27* and $T^4$ x PI 58548 were resistant to all isolates of leaf rust. Twenty-eight virulence combinations on fourteen genes for resistance were identified in 1978.

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Arrivee au Manitoba vers le 21 juin, la rouille de la feuille était, a la mi-juillet, largement répandue dans cette province et dans l'est de la Saskatchewan. Par apres, sa progression a ete lente et, somme toute, la maladie n'a infligé que peu de dégâts aux cultures de blé. L'enquête epidemiologique a été réalisée sur 19 lignées de rétrocroisement utilisées comme varietes réactifs, chacune possedant un gene unique de resistance. Les lignees possedant les genes Lr 17, *Lr 76*, *Lr 79*, *Lr 27* et $T^4$ x PI 58548 se sont montrees resistantes a tous les isolats de rouille. Vingt-huit combinaisons de virulence envers 14 genes de resistance ont été observées.

#### Disease development and crop losses in western Canada

Leaf rust (*Puccinia recondita* Rob. ex. Desm.) was first found on wheat (*Triticum aestivum* L.) in Manitoba on June 21. It was widespread in Manitoba and eastern Saskatchewan by mid-July but subsequent development was slow and leaf rust caused little damage in 1978. The bread wheat varieties Neepawa, Napayo and Manitou were moderately susceptible while Sinton was resistant and Glenlea highly resistant to leaf rust. All commercial durum varieties grown in Canada were resistant to leaf rust in 1978. The durum wheat varieties grown in Canada have always been resistant to leaf rust and virulence in the leaf rust population has never been observed on these varieties.

It was not possible to obtain reliable estimates of leaf rust prevalence and intensity on varieties in the rust nurseries. However, it was often possible to obtain small samples of leaf rust for race identification.

#### Physiologic specialization

Field collections of leaf rust were established on Little Club wheat in the greenhouse and one single-pustule isolate was taken from each collection for race identification. Urediospores from the remaining pustules were collected and bulked with collections from each geographic area to give composites that were used to inoculate a group of highly resistant varieties of wheat.

A total of 245 cultures were established in 1978 from the single-pustule isolates. These single pustule isolates were used to inoculate 19 backcross lines of wheat with single genes for resistance that served as differential varieties. Genes *Lr* 11, *Lr 16*, *Lr 19*, *Lr* 21 and $T^4$ x PI 58548 were resistant to all isolates of leaf rust and only two isolates, both from Ontario, were virulent on *Lr 9* (Table 1). In 1978, as in previous years (1), virulence on *Lr* 3, *Lr 10* and *Lr* 14a predominated in the leaf rust population. Virulence on *Lr* 1 and on the alleles at the *Lr* 2 locus, was at a very low level for many years but increased in the early 1970's and has remained fairly stable for several years. Leaf rust cultures from Manitoba and Saskatchewan tend to be virulent on the adult plant gene, *Lr* 13, derived from Frontana, while cultures from Ontario and Quebec tend to be virulent on the adult plant gene *Lr* 12, derived from Exchange. A total of 43 cultures were isolated from collections in Ontario and 36 of these were obtained from winter wheat.

Table 1. Virulence of isolates of *Puccinia recondita* on backcross lines containing single genes for resistance to leaf rust in Canada in 1978.

| Resistance genes | No of virulent isolates from | | | | | | | Total no of virulence isolates | % virulent isolates |
|---|---|---|---|---|---|---|---|---|---|
| | B C | Alta | Sask | Man | Ont | Que | N S | | |
| Lr 1 | 4 | 5 | 9 | 1 | 3 | 7 | 2 | 0 | 70 | 28 6 |
| | 0 | 1 | 8 | 1 | 2 | 0 | 0 | 0 | 21 | 8 6 |
| Lr 2b | 0 | 1 | 8 | 1 | 2 | 0 | 2 | 0 | 23 | 9 4 |
| Lr 2c | 6 | 15 | 9 | 13 | 42 | 10 | 5 | | 100 | 40 8 |
| Lr 8 | 2 | 7 | 0 | 0 | 4 | 1 | 1 | 0 | 4 | 64 | 26 1 |
| Lr 3 | 0 | 7 | 61 | 100 | 29 | 2 | 8 | | 207 | 84 5 |
| Lr 3ka | 0 | 0 | 2 | 2 | 2 | 8 | 2 | 2 | 36 | 14 7 |
| Lr 9 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | | 2 | 0 8 |
| Lr 10 | 6 | 17 | 45 | 79 | 39 | 7 | 4 | | 197 | 80 4 |
| Lr 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | *0* | *0 0* |
| Lr 14a | 0 | 5 | 61 | 100 | 33 | 10 | 4 | | 213 | 86 9 |
| Lr 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 0 |
| Lr 17 | 0 | 4 | 5 | 5 | 0 | 0 | 0 | | 14 | 5 7 |
| Lr 18 | 6 | 10 | 5 | 4 | 4 | 2 | 9 | 6 | 82 | 33 5 |
| Lr 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 0 |
| | *0* | *0* | *0* | *0* | *0* | *0* | *0* | | 0 | 0 0 |
| Lr 24 | 0 | 0 | 1 | 6 | 1 | 4 | 0 | 0 | 0 | 30 | 12 2 |
| | 0 | 0 | 2 | 2 | 1 | 4 | 2 | 0 | 20 | 8 2 |
| $T^4$ x PI 58548 | 0 | 0 | 0 | *0* | *0* | *0* | *0* | | *0* | *0 0* |

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Twenty-eight virulence combinations on fourteen genes for resistance were identified in 1978 (Table 2). Most of the isolates from the Canadian prairies combine virulence on ***Lr 3, Lr 10*** and ***Lr*** 14a. Most cultures from Ontario were virulent on ***Lr*** 18 and many combine virulence on ***Lr*** 3ka and ***Lr*** T.

Composite collections of leaf rust were used to inoculate a number of highly resistant varieties of wheat. A number of single pustule isolates that developed on these varieties were studied but no new combination of virulence was detected.

Table 2. Virulence combinations of ***Puccinia recondita*** isolates on backcross lines containing single genes for resistance to leaf rust in Canada in 1978.

| Avirulence/virulence formula | No. of isolates from: | | | | | | | Total no. of isolates |
|---|---|---|---|---|---|---|---|---|
| | B.C. | Alta. | Sask. | Man. | Ont. | Que. | N.S. | |
| 1,2a,2b,2c,B,3ka,9,10,17,18,24,T/3,14a | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 6 |
| 1,2a,1b,1c,B,3ka,9,17,18,24,T/3,10,14a | 0 | 2 | 39 | **62** | 1 | 0 | 0 | 104 |
| 1,2a,2b,2c,B,3ka,9,10,17,18,T/3,14a,24 | 0 | 0 | 13 | 11 | 0 | **0** | **2** | 26 |
| 1,2a,2b,2c,B,3ka,9,17,24,T/3,10,14a,18 | 0 | 0 | 1 | 1 | **0** | **0** | **0** | 2 |
| 1,2a,2b,2c,B,9,10,17,18,24,T/3,3ka,14a | **0** | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 1,2a,2b,2c,B,9,10,17,18,24/3,3ka,14a,T | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 2a,2b,2c,B,3ka,9,17,18,24,T/1,3,10,14a | 0 | 0 | 0 | 5 | **0** | 0 | 0 | 5 |
| 2a,2b,2c,B,3ka,9,10,18,24,T/1,3,14a,17 | **0** | 0 | 1 | 3 | **0** | **0** | **0** | 4 |
| 2a,2b,2c,B,3ka,9,10,17,18,T/1,3,14a,24 | 0 | 0 | 1 | 0 | 0 | 0 | **0** | 1 |
| 2a,2b,2c,B,3ka,9,17,18,T/1,3,10,14a,24 | **0** | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| 1,2a,2b,3,3ka,9,10,14a,17,24,T/2c,B,18 | **0** | 0 | 0 | 0 | 4 | 3 | 0 | 7 |
| 1,2a,2b,3,3ka,9,14a,17,18,24,T/2c,B,10 | **0** | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1,2a,2b,3,3ka,9,14a,17,24,T/2c,B,10,18 | **2** | 5 | 0 | 0 | 0 | 1 | 0 | **8** |
| 1,2a,2b,B,3ka,9,14a,18,24,T/2c,3,10,17 | **0** | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| 1,2a,2b,3ka,9,14a,17,24,T/2c,B,3,10,18 | **0** | 0 | 0 | 0 | 0 | 0 | 4 | 4 |
| 1,2a,2b,B,9,10,17,18,24,T/2c,3,3ka,14a | **0** | a | 0 | 0 | 0 | 0 | 1 | 1 |
| 2a,2b,B,3,3ka,9,14a,17,24,T/1,2c,10,18 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 5 |
| 2a,2b,3,3ka,9,17,24,T/1,2c,B,10,14a,18 | 0 | 2 | 0 | 0 | 9 | 0 | 0 | 11 |
| 1,B,3ka,9,17,18,24,T/2a,2b,2c,3,10,14a | 0 | 1 | **3** | 8 | 0 | **0** | **0** | 12 |
| 2a,2b,B,9,18,24/1,2c,3,3ka,10,14a,17,T | 0 | 0 | 1 | 1 | 0 | **0** | 0 | **2** |
| 1,B,9,17,18,24/2a,2b,2c,3,3ka,10,14a,T | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1,2a,2b,14a,17,24,T/2c,B,3,3ka,9,10,18 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 2a,9,14a,17,24/1,2b,2c,B,3,3ka,10,18,T | **0** | 0 | 0 | **0** | 0 | 1 | 0 | 1 |
| 2a,2b,14a,17,24,T/1,2c,B,3,3ka,9,10,18 | 0 | 0 | **0** | 0 | 1 | 0 | 0 | 1 |
| 2a,2b,9,14a,17,24,T/1,2c,B,3,3ka,10,18 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 12 |
| 2a,2b,9,14a,17,24/1,2c,B,3,3ka,10,18,T | **0** | 0 | 0 | 0 | 14 | 0 | 0 | 14 |
| B,3ka,9,10,17,24,T/1,2a,2b,2c,3,14a,18 | 0 | 0 | 2 | 2 | 0 | **0** | **0** | 4 |
| B,3ka,9,10,24,T/1,2a,2b,2c,3,14a,17,18 | 0 | 0 | 3 | 1 | 0 | **0** | **0** | 4 |

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**Literature cited**

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